Grizzly-PAW: Grizzly Population Assessment in yelloWhead: Integrated Approaches Toward Conserving Grizzly Bears On A Human-Dominated Landscape Of Western Alberta.

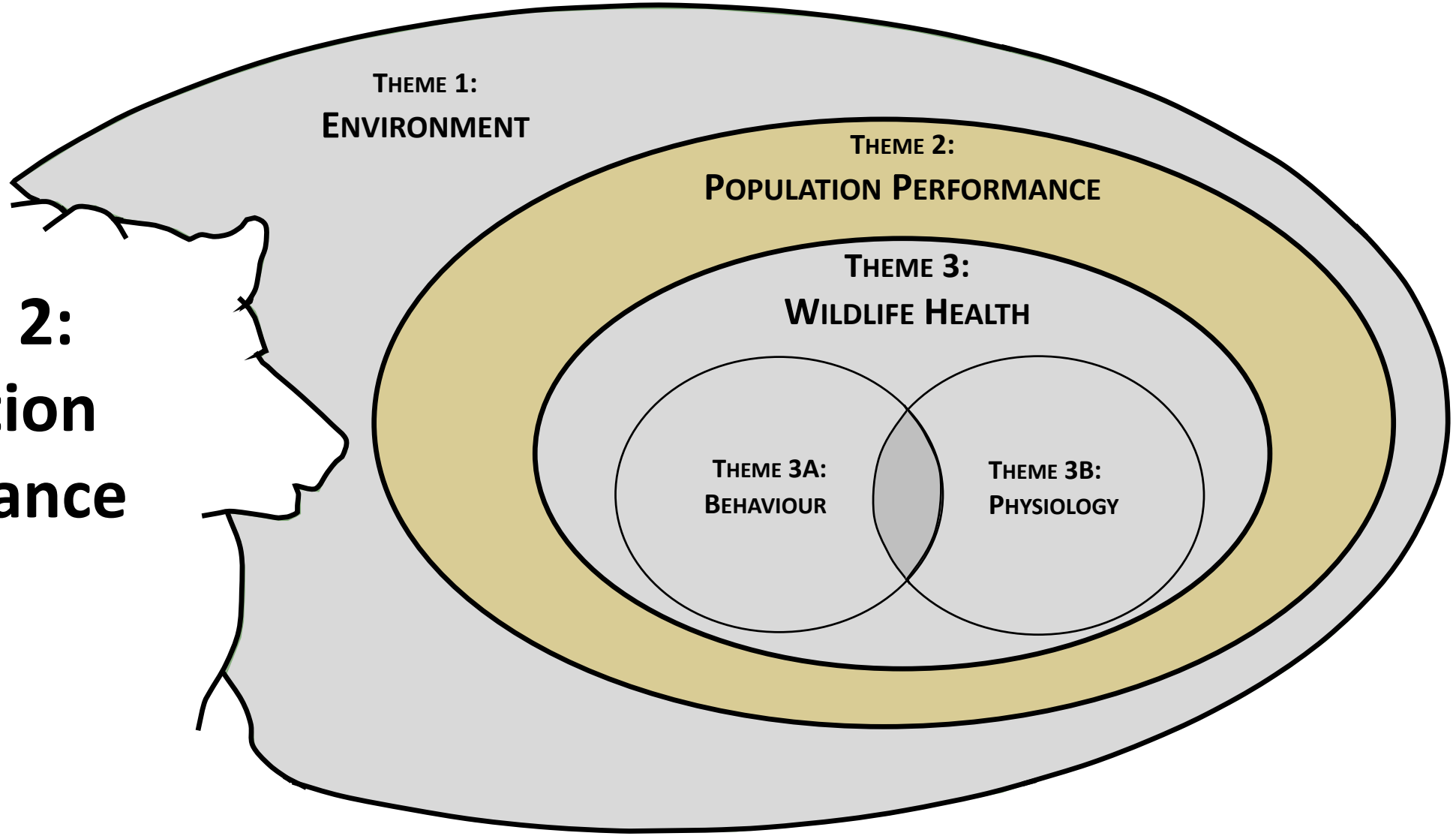
Annual General Meeting – 3 (AM)

Scott Nielsen, Univ. of Alberta

Calgary, Alberta

18 October 2019

Theme 2: Population performance



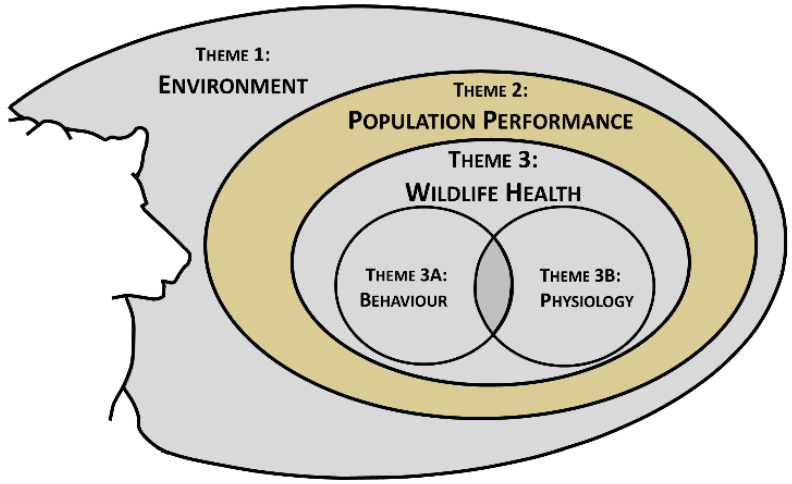
Theme 2 – Population performance (ecology)

Q1: Have **road density** thresholds influenced abundance & distribution (recovery) of bears?

Q2: Has **landscape change** (natural & anthropogenic) resulted in changes in population size/trends?

Q3: Can **carrying capacity** work be evaluated in terms of predicting densities & distribution of bears to inform recovery?

Q6: Do **existing models** used by resource managers continue to provide useful surrogates for habitat quality in changing landscapes?



Nutritional Landscape

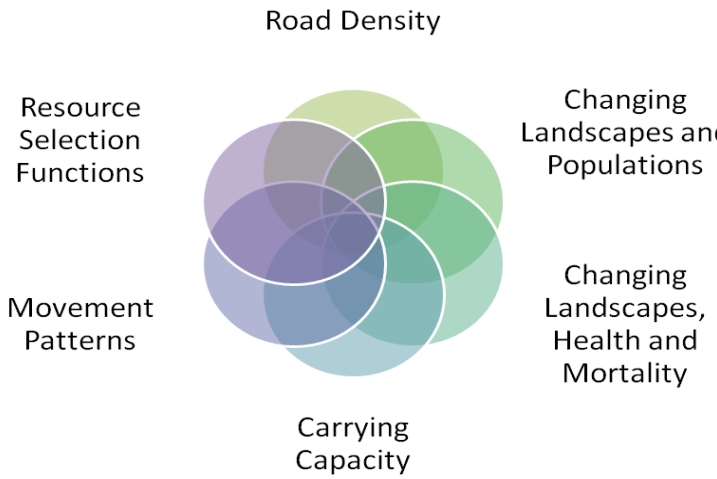
Bottom-up

N & *D*ensity

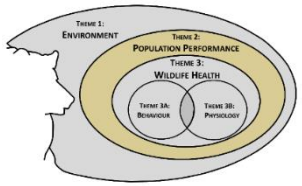
but also behaviour & health

Top-down

landscape change→ roads→human activity→ survival



Theme 2: personnel & projects



Sean Coogan *(post-doctoral fellow):*

- What are the nutritional constraints or trade-offs in our population & how does this affect individuals & populations?


Sean Coogan

Catherine Denny *(Research assistant)*

- What is the carrying capacity (recovery potential) of grizzlies?


Catherine Denny

Chris Souliere *(PhD student):*

- How does food supply change as a function of landscape change?
- How do bears respond to landscape patterns in food supply (agent-based models)?


Chris Souliere

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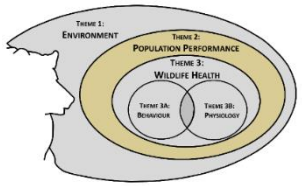

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Bottom-up factors (food supply)

- Nutrition critical for grizzly bears: e.g. hibernation, birth & survival of cubs (López-Alfaro et al. 2013)
- Anthropogenic disturbances can increase food supply (Nielsen et al. 2004)
- Cutblocks — herbs, ants, fruit, moose
- Roadsides — herbs (especially legumes - clover)

Lopez-Alfaro et al. 2013. Ecol Model 270, 1-10.
Nielsen et al. 2004. For Ecol Manage 199, 67-82.

Grizzly bear foraging behaviour

- Improved understanding of grizzly bear foraging behaviour
- Prefer specific ratios of protein, carbohydrate & fat (Erlenbach et al. 2014)
- Optimized mass gain
- Will mix their diets by consuming different foods (Coogan et al. 2014; Costello et al. 2016)

Erlenbach et al. 2014. J. Mammal 95, 160-168.
Coogan et al. 2014. PLoS ONE 9, e97968
Costello et al. 2016. PLoS ONE 11, e0153702

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REVIEW ARTICLE

WILEY Ecology and Evolution Open Access

Functional macronutritional generalism in a large omnivore, the brown bear

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Abstract

We combine a recently developed framework for describing dietary generalism with compositional data analysis to examine patterns of omnivory in a large widely distributed mammal. Using the brown bear (*Ursus arctos*) as a model species, we collected

- Coogan et al. (2018) review of macronutritional diets of brown bears
- Graphed nutritional geometry of bears
- Seasonal shifts in protein, carbohydrate & fat

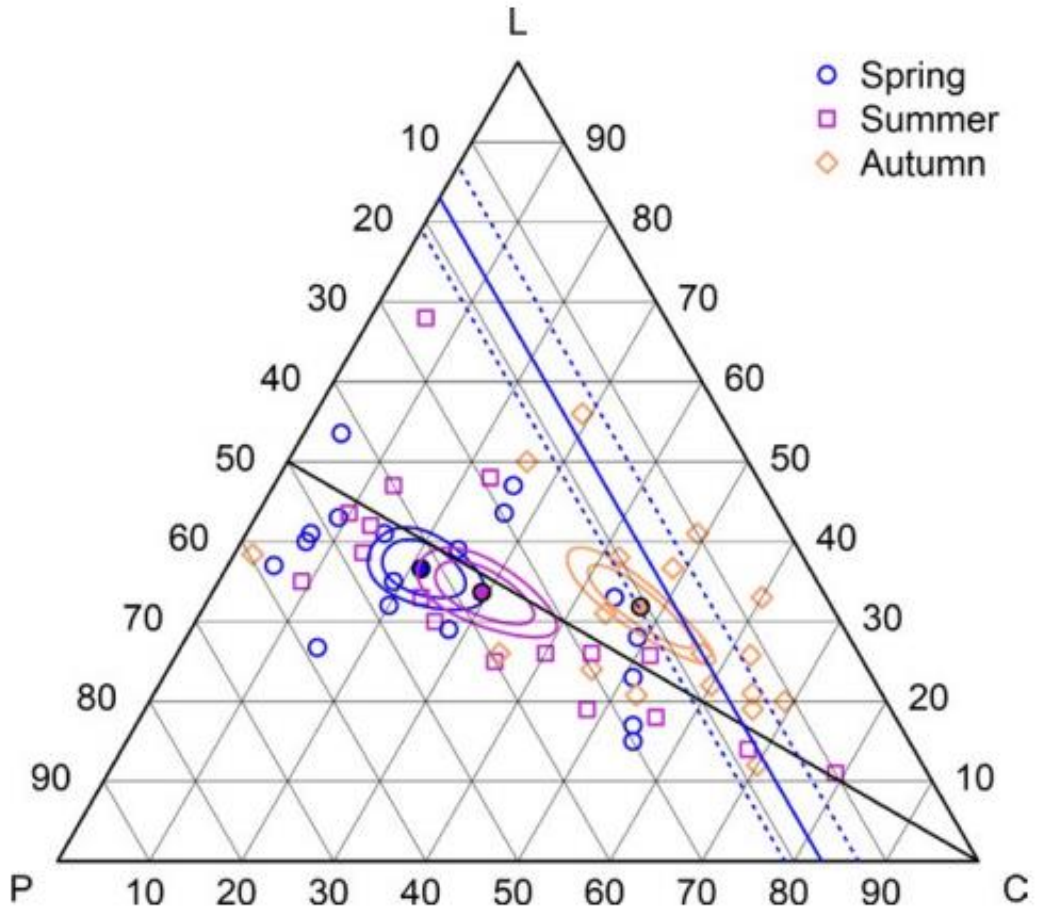
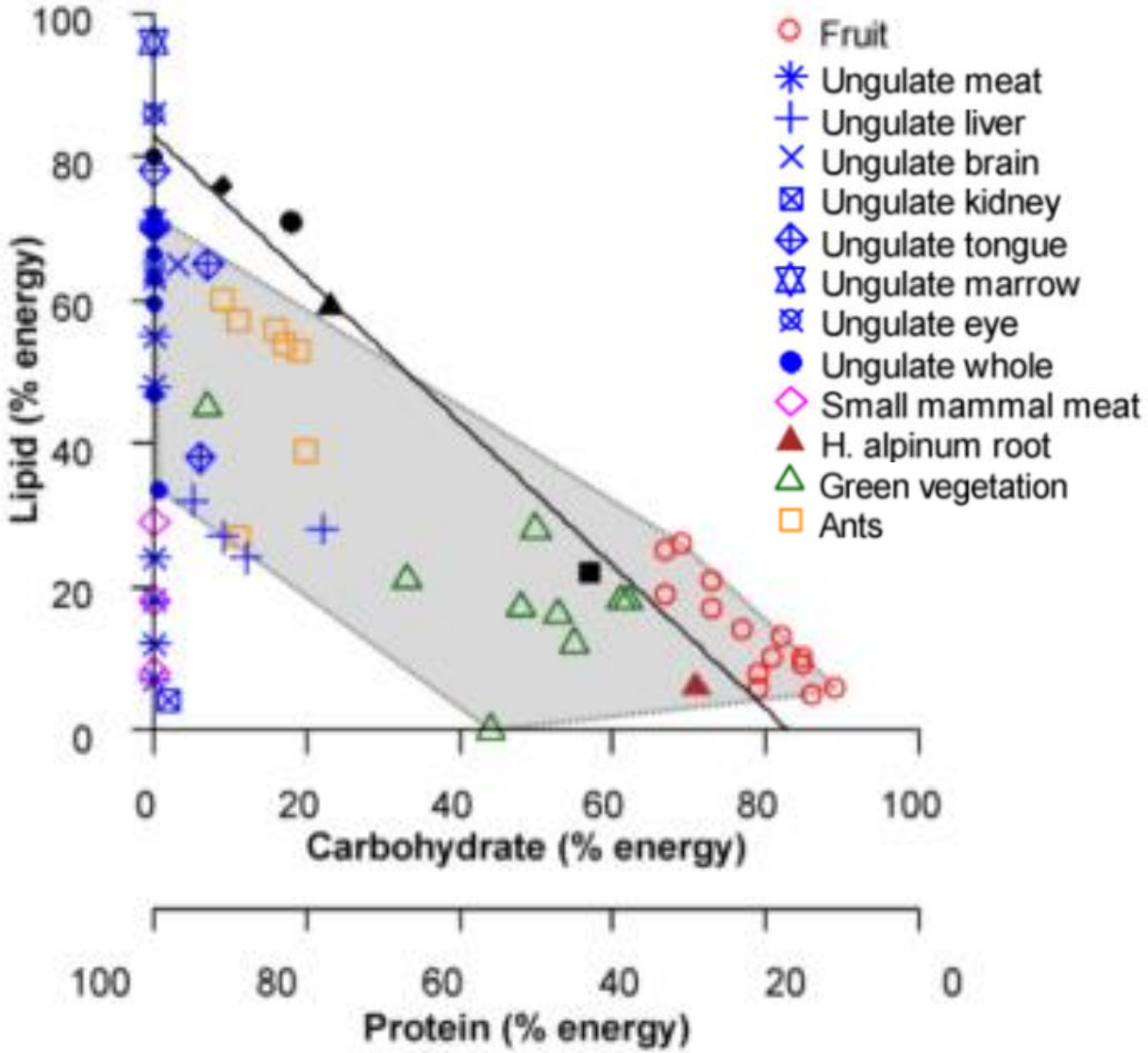


FIGURE 4 EMT of the proportions of macronutrients (protein = P, carbohydrate = C, and lipid = L) in seasonal brown bear diets. The geometric mean for each season is shown by a filled symbol surrounded by 90% and 99% confidence regions. For reference, the blue line represents the preferred optimal proportion of protein (17% ± 4) selected by captive bears. A black isoproportion line represents 1:1 proportions of protein and lipid

Why focus on ungulates & fruit?

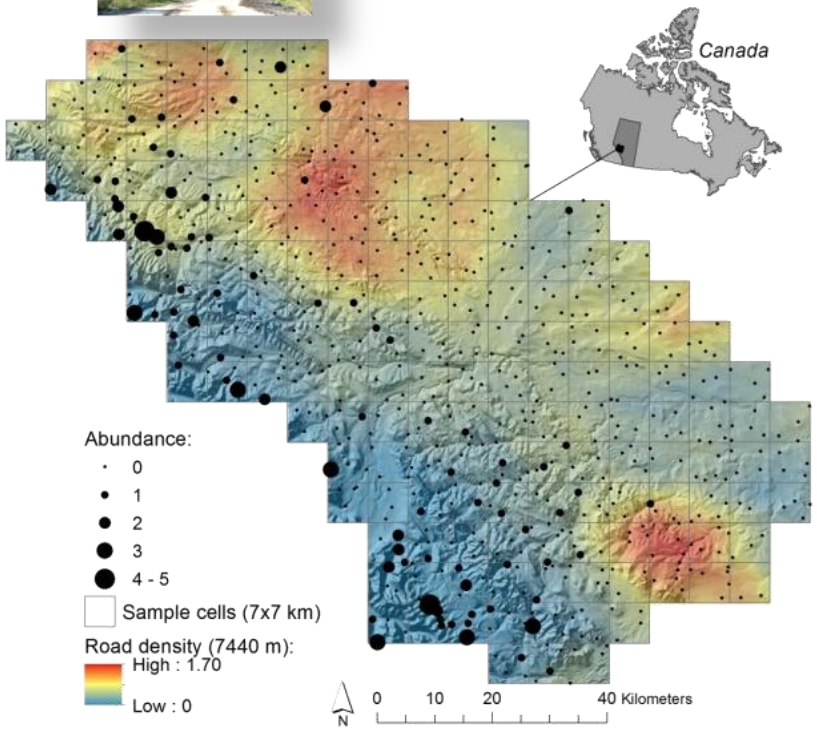


- They are highly complementary in their macronutrients
- Ungulates are high in protein energy & variable in lipid energy
- Fruit is high in carbohydrate energy
- A mixture of these two provides an optimal diet (mix)
- A number of papers promoting one or the other, but not both

Relationships to grizzly bear abundance in 2004

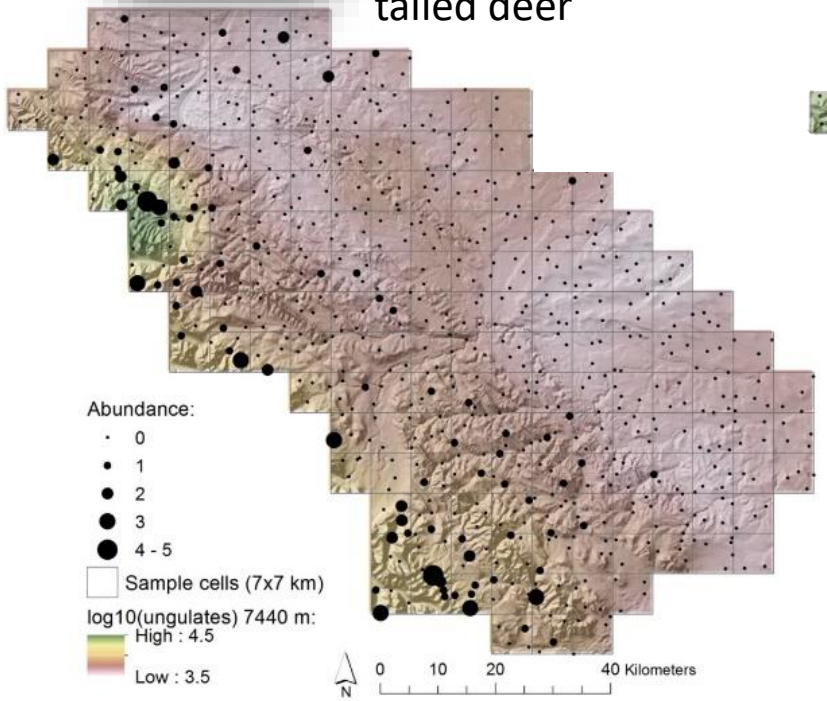
Top-down

Road density

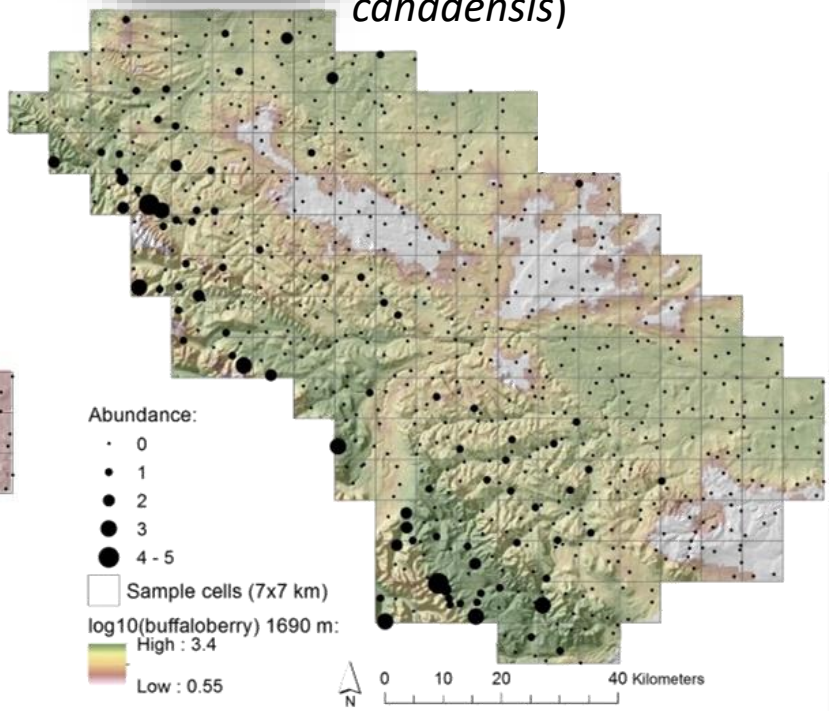


Bottom-up

elk, moose, bighorn sheep, mule & white-tailed deer

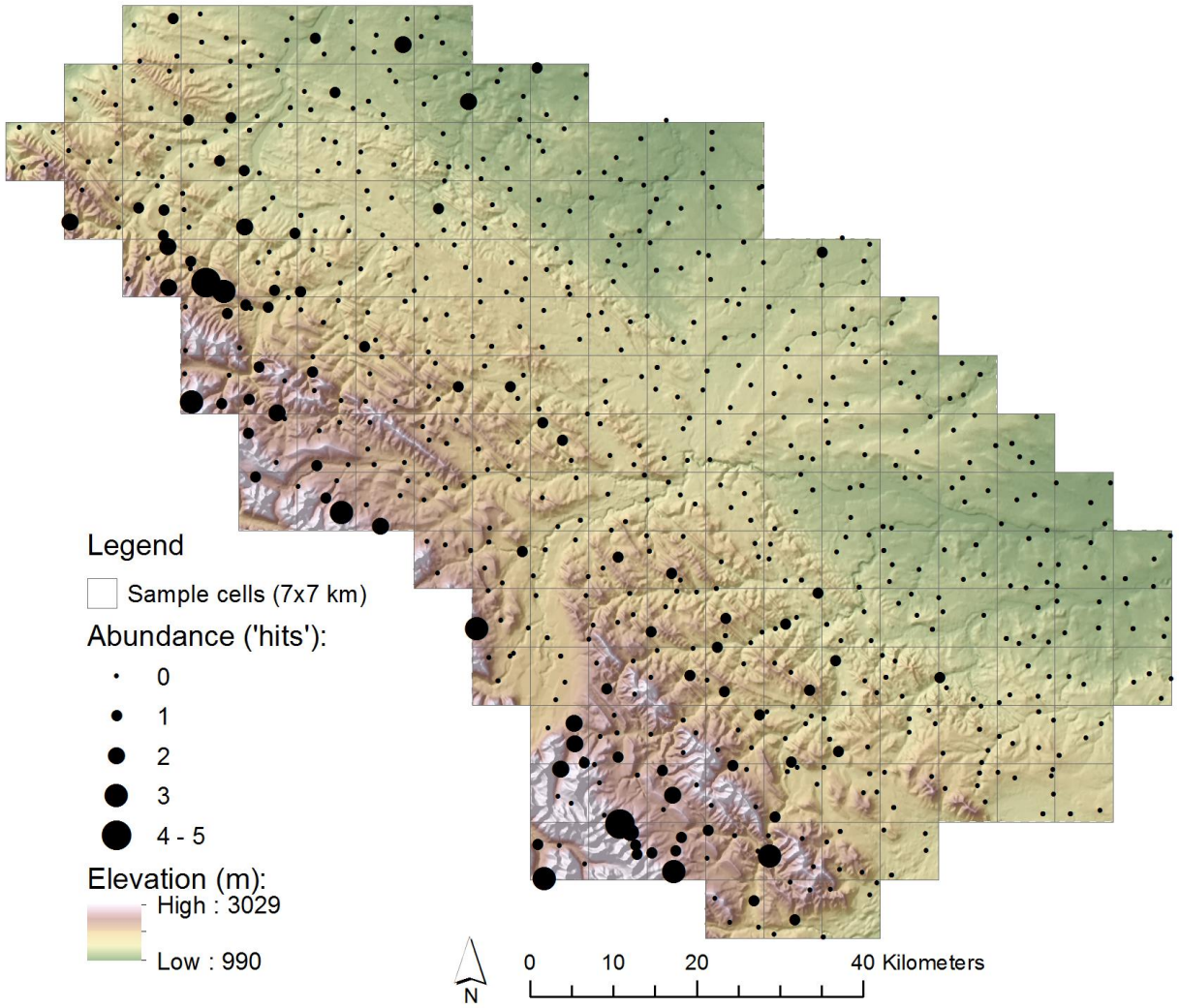


Canada buffaloberry (*Shepherdia canadensis*)

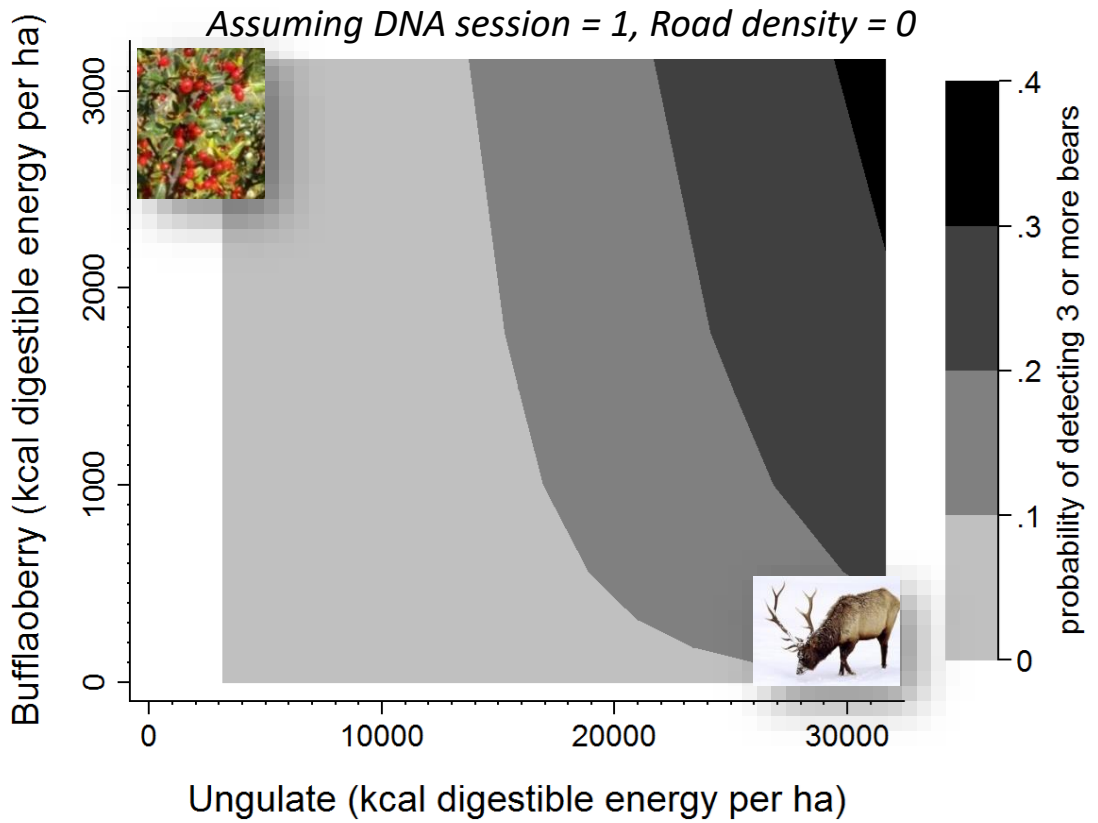


Nielsen et al. 2017. *Oikos* 126, 369-380

Meat, berries & bears



Variable	β	SE	e^β	e^βStdX
Session	-0.364	0.111	0.695	0.688
Road density (7440 m radius)	-0.662	0.420	0.516	0.761
log10(buffaloberry kcal w/in 1690 m)	0.754	0.273	2.125	1.994
log10(ungulate kcal w/in 7440 m)	4.080	0.520	59.12	1.998



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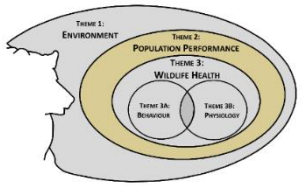
Theme 2: personnel & projects



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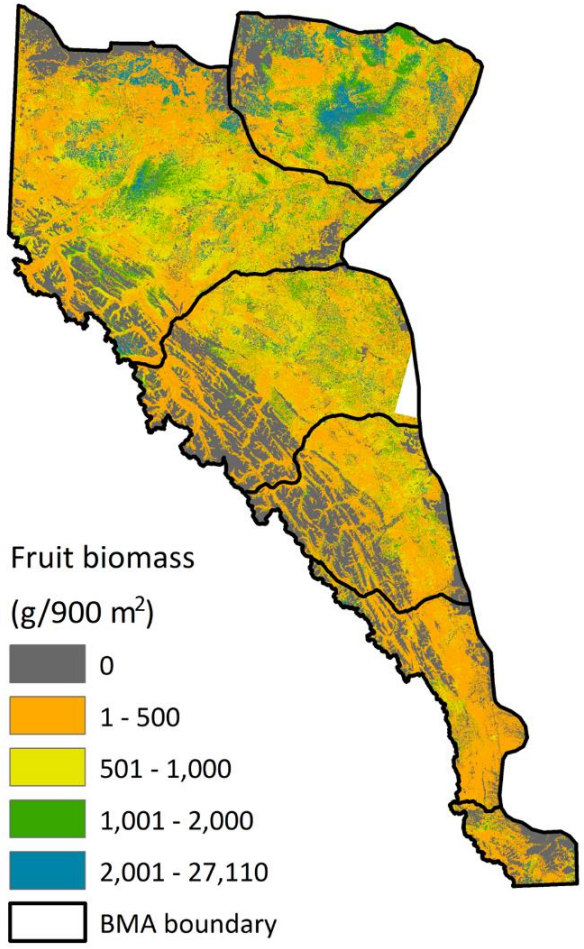
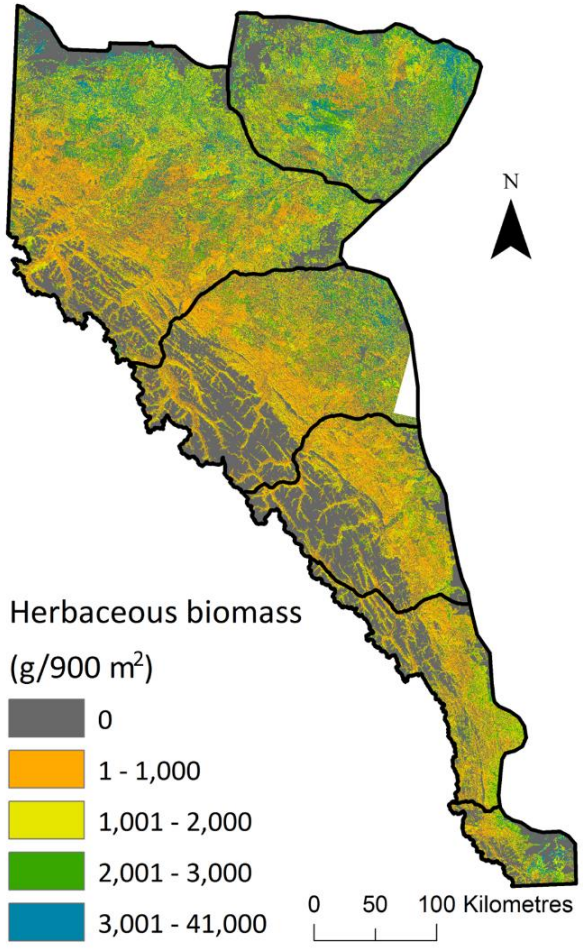
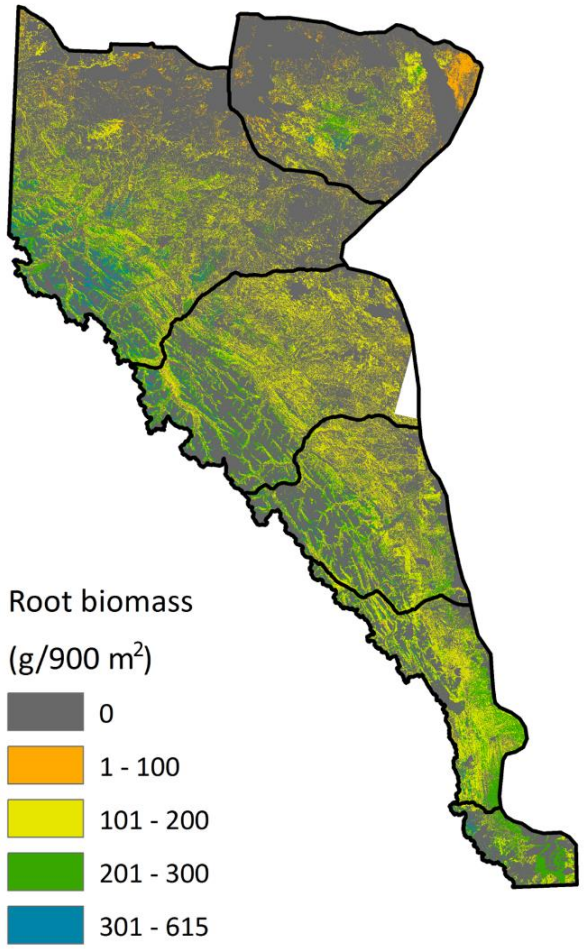
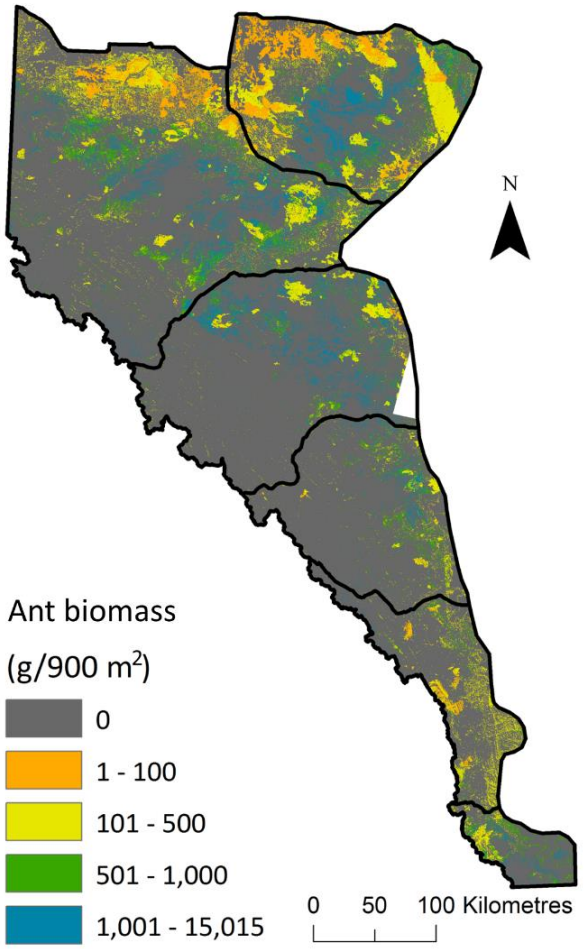
Models of food supply (plants + insects)



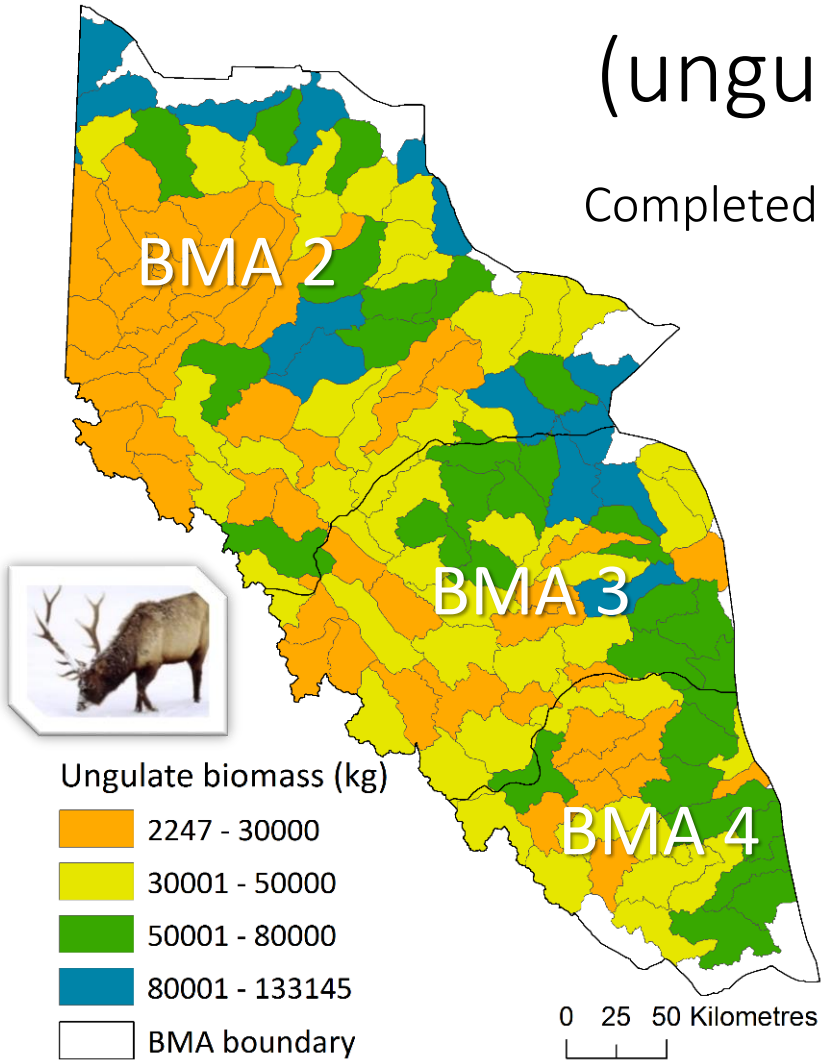


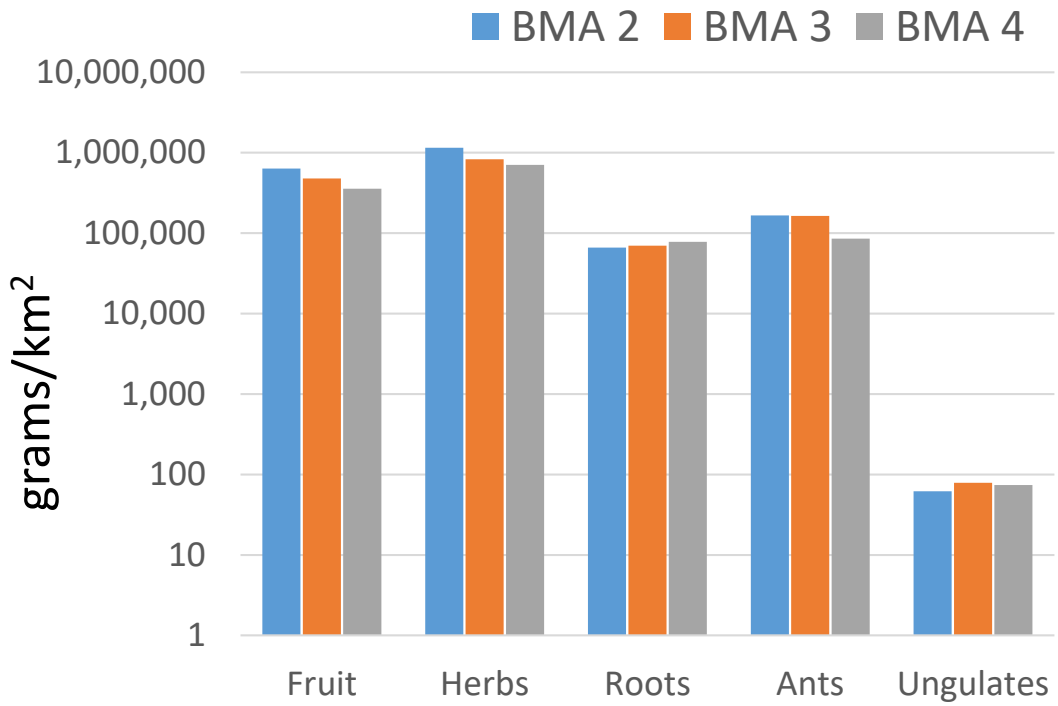




Models of food supply (ungulates)

Completed for 3 BMAs

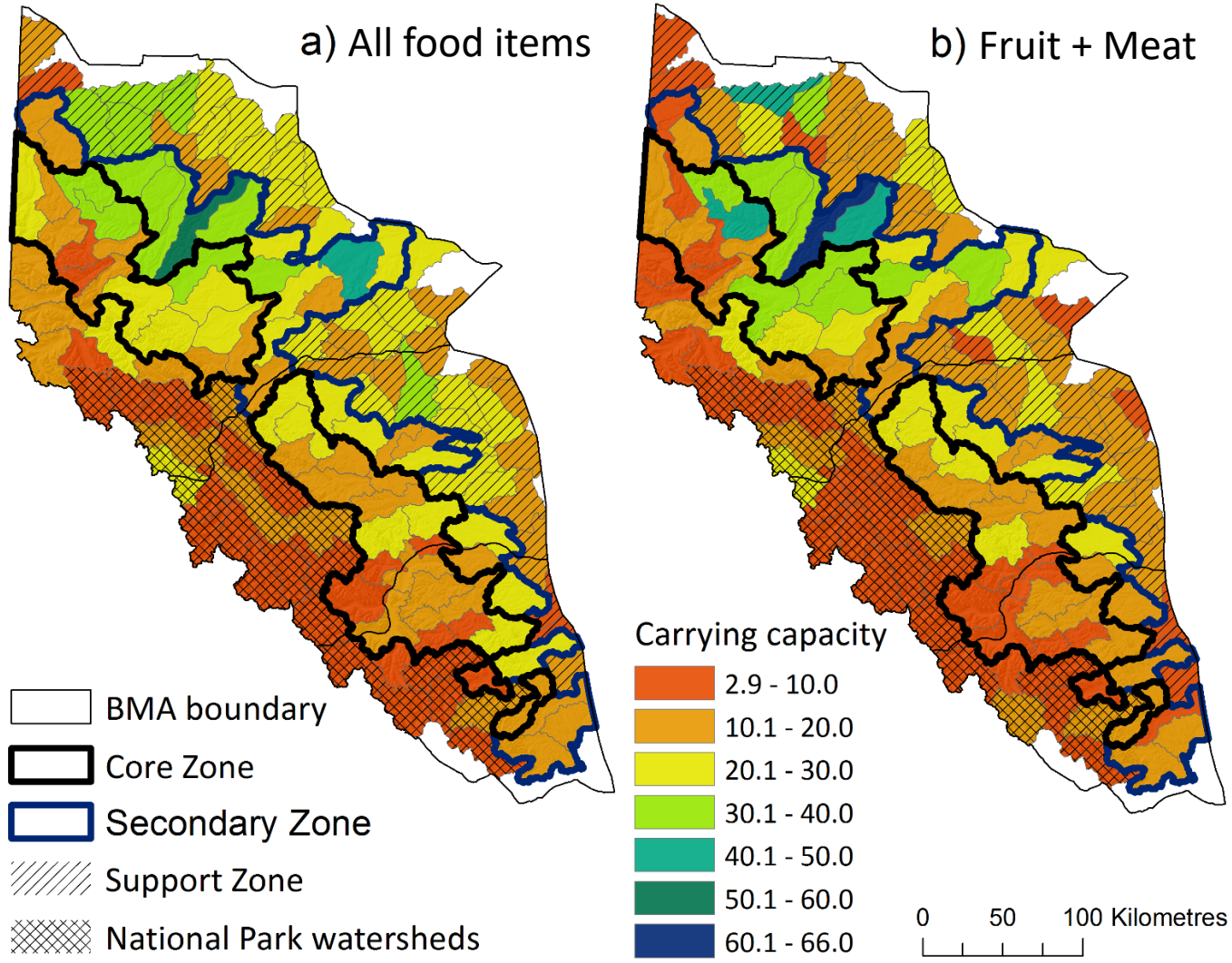


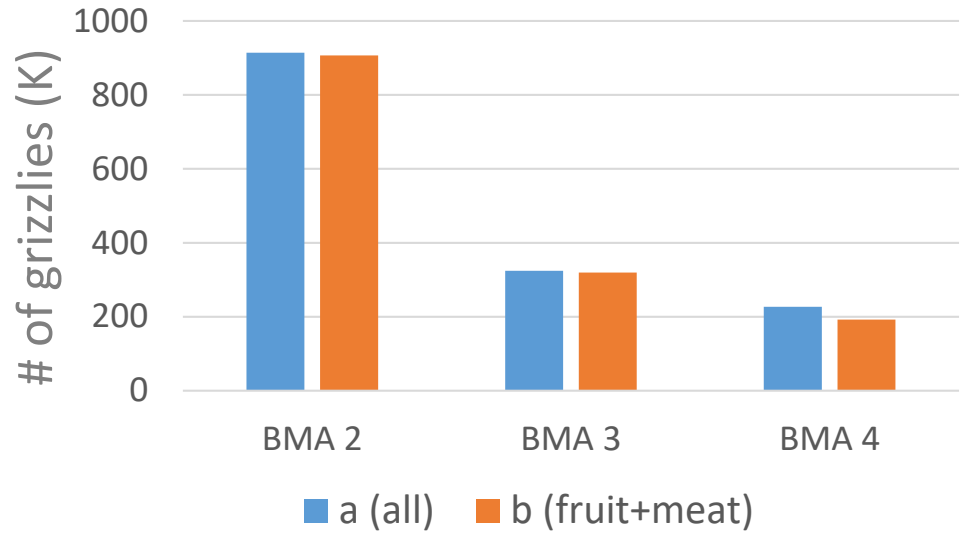


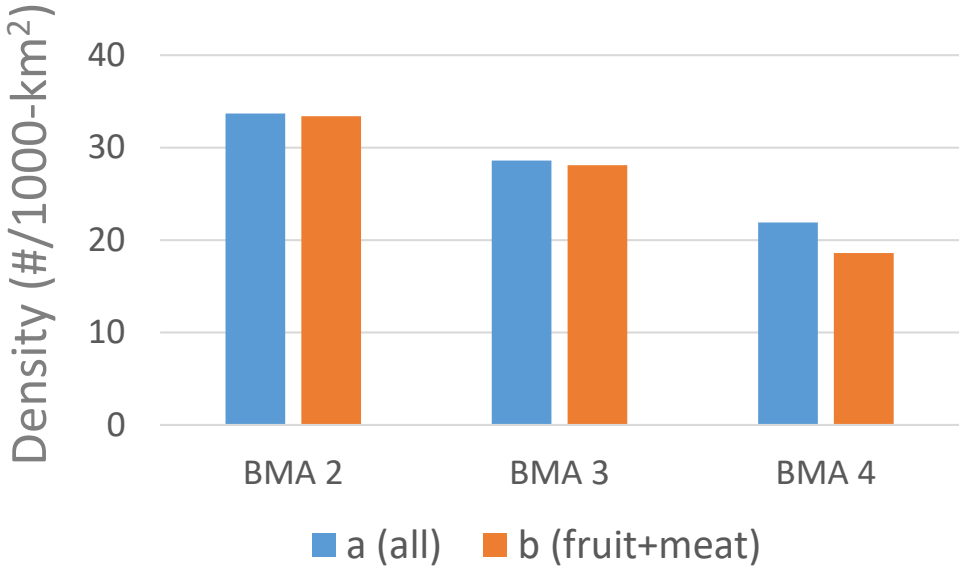
Average biomass (g per km²)	BMA 2	BMA 3	BMA 4
Fruit	634,887	478,729	356,448
Herbs	1,150,989	829,386	706,359
Roots	66,272	70,023	77,962
Ants	165,685	163,904	85,518
Ungulates	62	79	74

Denny et al. (in prep)

Carrying capacity (K)



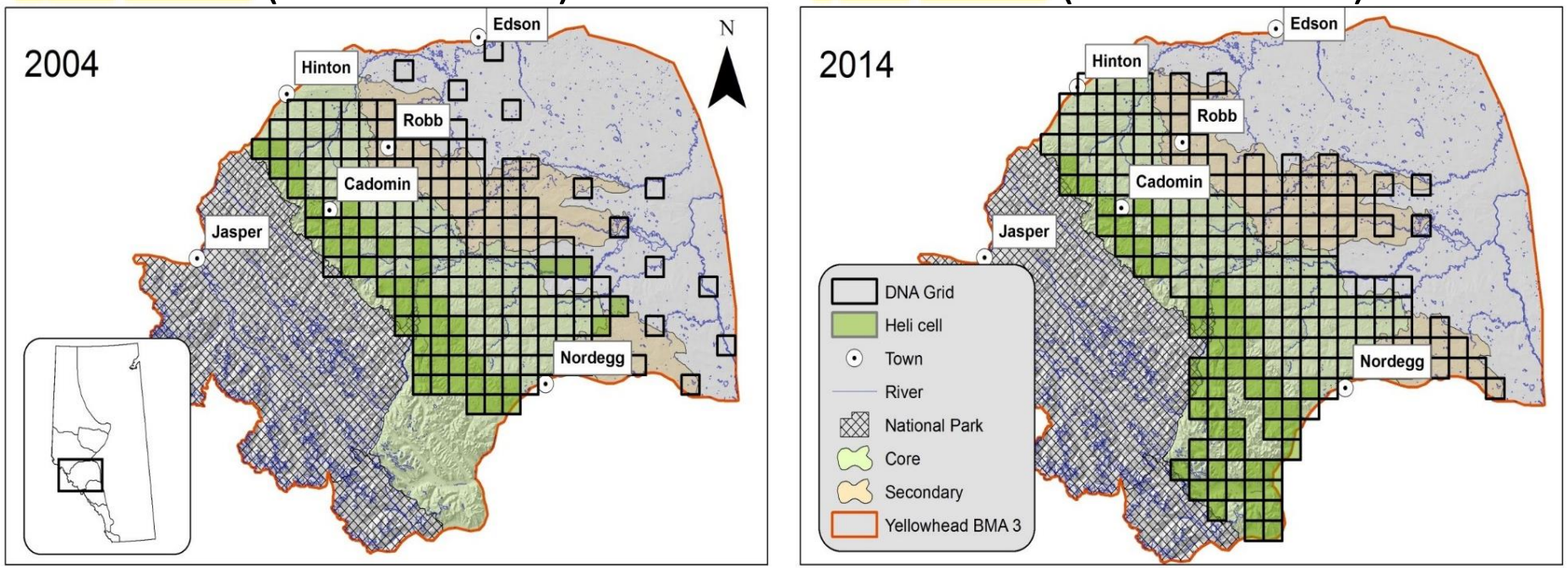




Next steps: changes in population (2004-14)

- Use nutritional landscape models parameterized for the two time periods
- Relate landscape change to differential patterns in population increase

36.0 bears (CI: 28.6-45.3) → **71.3 bears** (CI: 53.9-94.2)



Stenhouse et al. 2015. Estimates of grizzly bear population size and density.

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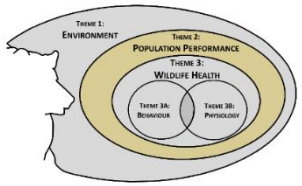

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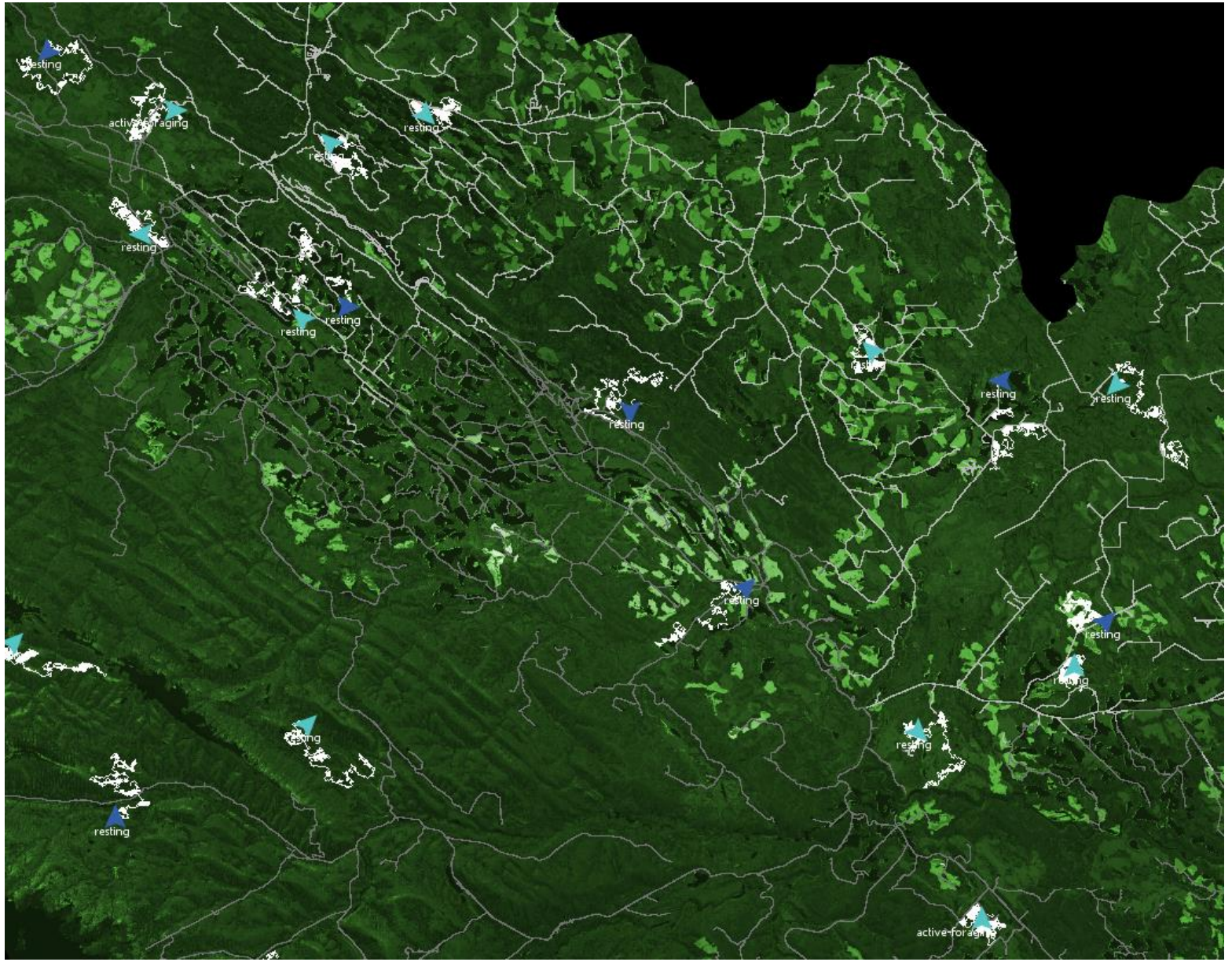
How do bears respond to landscape change?

Bears (agents)

What is the trade-off (relationship) between increases in food supply & lower survival with disturbances?



Digestible energy

High

Low

Record: growth (body weight), reproduction, survival

Acknowledgements & questions

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University of Alberta team:


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Catherine Denny


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